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AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

- 1-24 (Canceled)
- 25. (New) A process for hydrocyanating a hydrocarbon compound containing at least one ethylenic unsaturation by reacting it in a liquid medium with hydrogen cyanide in the presence of a catalyst comprising a metallic element selected from transition metals and an organic ligand, wherein the organic ligand corresponds to the general formula I below:

$$R_{1}$$
 U_{1}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{1}
 U_{2}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{1}
 U_{2}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{1}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{8}
 U_{1}
 U_{2}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{8}
 U_{8

in which:

T and T_1 , which are identical or different, represent a phosphorus, arsenic or antimony atom,

R₁, R₂, R₃ and R₄, which are identical or different, represent a substituted or unsubstituted, aromatic, aliphatic or cycloaliphatic radical having one or more rings,

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which are in fused form or not, optionally having one or more heteroatoms, wherein the radicals R_1 and R_2 on the one hand and R_3 and R_4 on the other hand are optionally interconnected by a covalent bond, a hydrocarbon chain or a heteroatom, U_1 , U_2 , U_3 and U_4 , which are identical or different, represent an oxygen atom or a

U₁, U₂, U₃ and U₄, which are identical or different, represent an oxygen atom or a radical of formula NR in which R denotes a monovalent alkyl, aryl, cycloalkyl, sulphonyl or carbonyl radical,

R₅ and R₆, which are identical or different, represent an aryl or cycloaliphatic group optionally having heteroatoms and/or one or more rings, in fused form or not, and which are substituted or unsubstituted,

n is an integer equal to 0 or 1,

 L_1 , when n is 0, represents a divalent radical selected from the group consisting of the groups NR₇, PR₈, SiR₉R₁₀, BR₁₁, S, POR₁₂, SO₂ and CO, in which R₇ is as defined for R above, R₈ and R₁₂ optionally represent the radical OR₁₃, and R₈, R₉, R₁₀, R₁₁, R₁₂ and R₁₃ represent alkyl, aryl or cycloalkyl radicals,

L₁ and L₂, when n is 1, are identical or different and represent a covalent bond or a radical selected from the group consisting of the groups O, NR₇, PR₈, SiR₉R₁₀, BR₁₁, S, POR₁₂, SO₂, CO and –CR₁₄R₁₅-, in which R₇ is as defined for R above, R₈ and R₁₂ optionally represent the radical OR₁₃, and R₈, R₉, R₁₀, R₁₁, R₁₂, R₁₃, R₁₄ and R₁₅ represent alkyl, aryl or cycloalkyl radicals, it being possible also for R₁₄ and R₁₅ to represent a hydrogen atom.

26. (New) The process according to Claim 25, wherein the organic ligand of general formula I presents a structure:

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$$O_{1}$$
 R_{5}
 L_{2}
 R_{6}

selected from the group consisting of the following structures:

in which R₁₇ represents an alkyl, aryl, halogen, alkoxy, thiol, cyano, nitro, aryloxy, alkoxycarbonyl, acyl or formyl radical.

27. (New) The process according to Claim 25, wherein the organic ligand of formula I is selected from the group consisting of:

tBu tBu	Ph P
tBu tBu	tBu tBu
tBu tBu	MeO COMe MeCO OMe MeO OMe COMe S MeCO tBu tBu
CHO CHO CHO CHO S CHO tBu tBu	tBu tBu
tBu tBu	tBu tBu

OMe MeO MeO OMe tBu tBu	NO PO NO
N N N N N N N N N N N N N N N N N N N	tBu tBu
CHO OMe MeO CHO CHO OPO OPO CHO MeO SHOW MEO	tBu tBu
tBu tBu	tBu tBu
tBu tBu	

tBu tBu	Ph Ph Ph Ph Ph Ph Ph
tBu tBu	tBu tBu
tBu tBu	MeO—COMe MeCO—OMe MeO COMe COMe MeCO COMe MeCO MeCO TBu TBu
CHO CHO—CHO CHO tBu tBu	tBu tBu
tBu tBu	tBu tBu

MeO OMe	tBu tBu
tBu tBu	tBu tBu
CHO OMe MeO CHO CHO OMe MeO MeO CHO MeO MeO MeO	tBu tBu
tBu tBu	tBu tBu
tBu tBu	

tBu S tBu	Ph P
tBu S tBu Me	O P O P O HBU S HBU Me Me
tBu S IBu	MeO COMe MeCO OMe MeO OMe
CHO CHO CHO CHO Bu S HBu KBu CHO Me Me	tBu S tBu
tBu S tBu	tBu S tBu

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OMe MeO OPO NeO tBu Ne Me Me Me Me Me Me Me Me Me Me	tBu S tBu
N N N N N N N N N N N N N N N N N N N	tBu S tBu
CHO OMe MeO CHO OMe tBu Me	tBu S tBu
tBu S tBu	tBu S tBu
tBu S tBu Me	

	Ph Ph—
	MeO————————————————————————————————————
CHO CHO CHO	

OMe MeO MeO OMe OMe	
CHO OME MEO CHO OME S MEO	

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	Ph Ph— Ph— Ph Ph— Ph Ph— Ph Ph— Ph Ph
	MeO————————————————————————————————————
CHO CHO—CHO	
OMe MeO OMe OMe OMe	

CHO OMe MeO CHO CHO OMe MeO MeO CHO MeO	
	Ph Ph

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	MeO COMe MeCO OMe OMe COMe MeCO MeCO MeCO
сно сно	
OMe MeO OMe OMe	
CHO CHO CHO OMe MeO CHO MeO	

	•
MeO OMe	Ph Ph Ph Ph Ph OMe
MeO OMe	MeO OMe
MeO OMe	MeO COMe MeCO OMe OMe OMe OMe OMe OMe OMe OMe
CHO CHO CHO CHO CHO CHO OMe	MeO OMe

MeO OMe	MeO OMe
OMe MeO OMe MeO OMe	MeO OMe
N N N N N N N N N N N N N N N N N N N	MeO OMe
CHO OMe MeO CHO OMe MeO OMe MeO OMe	MeO OMe
MeO OMe	MeO OMe
MeO OMe	,

OMe	Ph Ph Ph OMe
OMe	A COME
OMe	MeO — COMe MeCO — OMe OMe OMe OMe OMe
CHO CHO CHO CHO	OMe
OMe	OMe
OMe MeO OMe OMe OMe	OMe OMe

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N N N N N N N N N N N N N N N N N N N	O O O O O O O O O O O O O O O O O O O
CHO OME MEO CHO OME MEO OME	OMe
OMe	OMe
OMe	
	Ph Ph

	MeO COMe MeCO OMe OMe OMe OMe OMe OMe OMe
CHO CHO CHO	
OMe MeO OMe OMe	
CHO OMe MeO CHO CHO OMe MeO MeO	

Ph Ph Ph Ph
MeO————————————————————————————————————

CHO CHO—CHO	
OMe MeO OMe OMe	
CHO OME MEO CHO OME MEO MEO	

Ph Ph
MeO————————————————————————————————————

CHO CHO CHO CHO	
OMe MeO OMe OMe	
CHO OME MeO CHO OME OME MEO MEO	

O Ph O Po P	Ph Ph Ph Ph Ph Ph Ph Ph
O Ph O Po	
O Ph O Ph	MeO COMe MeCO OMe MeO OMe COMe Ph OPO COMe Ph MeCO
CHO CHO CHO CHO	S o ph o f o f
O P O Ph O P O P	Ph Po

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28. (New) The process according to Claim 25, wherein the metallic element is selected from the group consisting of nickel, cobalt, iron, ruthenium, rhodium, palladium, osmium, iridium, platinum, copper, silver, gold, zinc, cadmium and mercury.

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- 29. (New) The process according to Claim 25, wherein the reaction is carried out in a single-phase medium.
- 30. (New) The process according to Claim 25, wherein the catalyst corresponds to the general formula (II):

 $M[L_f]_t$ (II)

in which

M is a transition metal,

L_f represents the organic ligand of formula (I) and t represents a number between 1 and 4 (inclusive).

- 31. (New) The process according to Claim 25, wherein the liquid medium further comprises a solvent for the catalyst which is miscible with a phase comprising the compound to be hydrocyanated at the hydrocyanation temperature.
- 32. (New) The process according to Claim 25, wherein the transition metal compounds are nickel compounds in which nickel is in oxidation state zero, nickel carboxylates, carbonate, bicarbonate, borate, bromide, chloride, citrate, thiocyanate, cyanide, formate, hydroxide, hydrophosphite, phosphite, phosphate and derivatives, iodide, nitrate, sulphate, sulphite, arylsulphonates or alkylsulphonates.
- 33. (New) The process according to Claim 25, wherein the hydrocarbon compound containing at least one ethylenic unsaturation is a diolefin, ethylenically unsaturated aliphatic nitrile, linear pentenenitrile, or monoolefin.
- 34. (New) The process according to Claim 25, wherein the transition metal is used in a amount of between 10⁻⁴ and 1 mol of transition metal per mole of hydrocarbon

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compound and wherein the organic ligand of formula (I) is used in a number of moles of from 0.5 to 50 relative to 1 mol of transition metal.

- 35. (New) The process according to Claim 25, wherein the hydrocyanation reaction is carried out at a temperature from 10°C to 200°C.
- 36. (New) The process according to Claim 25 for hydrocyanating ethylenically unsaturated nitrile compounds to dinitriles, being operated in the presence of a catalyst system comprising at least one transition metal compound, at least one organic compound of formula (I) and a cocatalyst composed of at least one Lewis acid.
- 37. (New) The process according to Claim 36, wherein the ethylenically unsaturated nitrile compounds are pent-3-enenitrile, pent-4-enenitrile or mixtures thereof.
- 38. (New) The process according to Claim 37, wherein the linear pentenenitriles contain amounts of other compounds selected from the group consisting of 2-methylbut-3-enenitrile, 2-methylbut-2-enenitrile, pent-2-enenitrile, valeronitrile, adiponitrile, 2-methylglutaronitrile, 2-ethylsuccinonitrile and butadiene.
- 39. (New) The process according to Claim 36, wherein the Lewis acid is selected from compounds of the elements of groups Ib, IIb, IIIa, IIIb, IVa, IVb, Va, Vb, VIb, VIIb and VIII of the Periodic Table of the Elements.
- 40. (New) The process according to Claim 36, wherein the Lewis acid is selected from salts selected from the group of halides, sulphates, sulphonates, haloalkylsulphonates, perhaloalkylsulphonates, haloalkylacetates, perhaloalkylacetates, carboxylates and phosphates.

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- 41. (New) The process according to Claim 36, wherein the Lewis acid is zinc chloride, zinc bromide, zinc iodide, manganese chloride, manganese bromide, cadmium chloride, cadmium bromide, stannous chloride, stannous bromide, stannous sulphate, stannous tartrate, indium trifluoromethylsulphonate, indium trifluoroacetate, zinc trifluoroacetate, lanthanum chloride, cerium chloride, praseodymium chloride, neodymium chloride, samarium chloride, europium chloride, gadolinium chloride, terbium chloride, dysprosium chloride, hafnium chloride, erbium chloride, thallium chloride, ytterbium chloride, lutetium chloride, lanthanum bromide, cerium bromide, praseodymium bromide, neodymium bromide, samarium bromide, europium bromide, gadolinium bromide, terbium bromide, dysprosium bromide, hafnium bromide, erbium bromide, thallium bromide, ytterbium bromide, lutetium bromide, cobalt chloride, ferrous chloride, or yttrium chloride.
- 42. (New) The process according to Claim 36, wherein the Lewis acid employed represents from 0.01 to 50 mol per mole of transition metal compound.
- 43. (New) The process according to Claim 36, wherein 2-methylbut-3-enenitrile, present in the reaction mixture originating from butadiene hydrocyanation, is isomerized to pentenenitriles in the absence of hydrogen cyanide, in the presence of a catalyst comprising at least one organic ligand of general formula (I) and at least one transition metal compound.
- 44. (New) The process according to Claim 43, wherein the 2-methylbut-3-enenitrile subjected to isomerization is employed alone or in a mixture with 2-methylbut-2-enenitrile, pent-4-enenitrile, pent-3-enenitrile, pent-2-enenitrile,

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butadiene, adiponitrile, 2-methylglutaronitrile, 2-ethylsuccinonitrile or valeronitrile.

- 45. (New) The process according to Claim 43, wherein the isomerization reaction is carried out at a temperature from 10°C to 200°C.
- 46. (New) The process according to Claim 43, wherein the isomerization of 2-methylbut-3-enenitrile to pentenenitriles is carried out in the presence of at least one transition metal compound, at least one organic phosphorous ligand of the formula (I) and a cocatalyst composed of at least one Lewis acid.
- 47. (New) Organophosphorus compounds corresponding to the general formula I below:

$$R_{1}$$
 U_{1}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{1}
 U_{2}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{1}
 U_{2}
 U_{2}
 U_{3}
 U_{4}
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 U_{5}
 U_{6}
 U_{7}
 U_{8}
 U_{1}
 U_{1}
 U_{2}
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 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{8}
 U_{1}
 U_{1}
 U_{2}
 U_{3}
 U_{4}
 U_{4}
 U_{5}
 U_{6}
 U_{7}
 U_{8}
 U_{8

in which:

T and T₁, which are identical or different, represent a phosphorus, arsenic or antimony atom,

R₁, R₂, R₃ and R₄, which are identical or different, represent a substituted or unsubstituted, aromatic, aliphatic or cycloaliphatic radical having one or more rings, which are in fused form or not and optionally contain one or more heteroatoms,

wherein the radicals R_1 and R_2 on the one hand and R_3 and R_4 on the other hand optionally be interconnected by a covalent bond, a hydrocarbon chain or a heteroatom, U_1 , U_2 , U_3 and U_4 , which are identical or different, represent an oxygen atom or a radical of formula NR in which R denotes a monovalent alkyl, aryl, cycloalkyl, sulphonyl or carbonyl radical,

R₅ and R₆, which are identical or different, represent an aryl or cycloaliphatic group optionally comprise heteroatoms and/or one or more rings, in fused form or not, and which are substituted or unsubstituted,

n is an integer equal to 0 or 1,

L₁, when n is 0, represents a divalent radical selected from the group consisting of the groups NR₇, PR₈, SiR₉R₁₀, BR₁₁, S, POR₁₂, SO₂ and CO, in which R₇ is as defined for R above, R₈ and R₁₂ may represent the radical OR₁₃, and R₈, R₉, R₁₀, R₁₁, R₁₂ and R₁₃ represent alkyl, aryl or cycloalkyl radicals,

L₁ and L₂, when n is 1, are identical or different and represent a covalent bond or a radical selected from the group consisting of the groups O, NR₇, PR₈, SiR₉R₁₀, BR₁₁, S, POR₁₂, SO₂, CO and –CR₁₄R₁₅-, in which R₇ is as defined for R above, R₈ and R₁₂ optionally represent the radical OR₁₃, and R₈, R₉, R₁₀, R₁₁, R₁₂, R₁₃, R₁₄ and R₁₅ represent alkyl, aryl or cycloalkyl radicals, it being possible also for R₁₄ and R₁₅ to represent a hydrogen atom.

48. (New) Organophosphorus compounds, corresponding to the formulae below:

... \

tBu tBu	Ph P
tBu tBu	tBu tBu
tBu tBu	MeO COMe MeCO OMe MeO OMe COMe S MeCO tBu tBu
CHO CHO— CHO CHO S CHO tBu tBu	tBu tBu
tBu tBu	tBu tBu

OMe MeO	
	No-Po OPON
MeO ÓMe	S S
tBu tBu	tBu
N POPOLON	
	S S
tBu tBu	tBu tBu
CHO CHO	
сно Ро ОРОСНО	
OMe S MeO	
tBu	tBu
\bigcirc \bigcirc	
S	s
tBu tBu	tBu tBu
tBu tBu	

tBu tBu	Ph P
tBu tBu	tBu tBu
tBu tBu	MeO COMe MeCO OMe MeO OMe COMe MeCO OMe MeCO OMe MeCO OMe MeCO OMe MeCO OMe
CHO CHO—CHO CHO tBu tBu	tBu tBu
tBu tBu	tBu tBu

MeO PO OMe	N N N N N N N N N N N N N N N N N N N
NO PON THU THU	tBu tBu
CHO OME MEO CHO OME MEO TO THE MEO THE MEO TO THE MEO THE M	tBu tBu
tBu tBu	tBu tBu
tBu tBu	

tBu S tBu	Ph Ph Ph Ph Ph tBu Ph tBu Ph
tBu S tBu	tBu S tBu Me
tBu S tBu	MeO COMe MeCO OMe OMe OMe OMe OMe The complete of the com
CHO CHO— CHO tBu S tBu CHO Me Me	tBu S tBu
tBu S tBu	tBu S tBu

OMe MeO OPO MeO tBu S tBu OMe Me Me Me	1Bu S tBu
tBu S tBu	1Bu S tBu
CHO OME MEO CHO CHO OME MEO CHO MEO CHO MEO CHO MEO CHO MEO CHO MEO MEO MEO M	tBu S tBu
tBu S tBu	1Bu S tBu Me Me
tBu S tBu Me	

	Ph Ph— Ph— Ph— Ph— Ph Ph Ph
	MeO————————————————————————————————————
CHO CHO CHO	

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OMe MeO MeO OMe OMe	
CHO OMe MeO CHO OMe MeO MeO CHO	

	Ph Ph
	MeO — COMe MeCO — OMe OMe OMe OMe OMe OMe OMe
CHO CHO—CHO	
OMe MeO OPO OMe OMe	N N N N N N N N N N N N N N N N N N N

CHO OMe MeO CHO CHO OMe MeO MeO CHO	
Si	
	,
	Ph Ph Ph Ph Ph

	MeO—COMe MeCO—OMe MeO COMe MeCO MeCO MeCO MeCO MeCO
сно сно	
OMe MeO OMe OMe	
CHO CHO CHO OMe MeO CHO OMe MeO	

MeO OMe	Ph Ph Ph Ph Ph OMe
MeO OMe	MeO OMe
MeO OMe	MeO COMe MeCO OMe OMe OMe COMe MeO OMe OMe OMe
CHO CHO CHO CHO CHO CHO OMe	MeO OMe

MeO OMe	MeO OMe
OMe MeO OMe OMe OMe	MeO OMe
NO PO O PO NO	MeO OMe
CHO OMe CHO OMe MeO CHO OMe MeO OMe OMe OMe	MeO OMe
MeO OMe	MeO OMe
MeO OMe	

OMe	Ph P
OMe OMe	A COME
OMe	MeO — COMe MeCO — OMe OMe OMe OMe OMe OMe
CHO CHO— CHO CHO CHO OMe	OMe
OMe OMe	OMe
OMe MeO MeO OMe OMe	N N N N N N N N N N N N N N N N N N N

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N-V	
N P O N O N O N O N O N O N O N O N O N	OMe
CHO OMe MeO CHO CHO OMe MeO OMe OMe OMe OMe	OME
OMe	OMe
OMe	
	Ph Ph Ph Ph

	MeO COMe MeCO OMe OMe COMe MeCO MeCO MeCO
сно сно	
OMe MeO OMe OMe	
CHO OMe MeO CHO CHO OMe MeO MeO	

Ph Ph Ph Ph Ph
MeO COMe MeCO OMe

сно сно-	
OMe MeO OMe OMe	
CHO OMe MeO CHO CHO OMe MeO MeO	

Ph Ph
MeO————————————————————————————————————

CHO CHO—CHO	
OMe MeO OMe OMe	
CHO CHO CHO CHO OMe MeO MeO CHO	

O Ph O Ph	Ph Ph Ph Ph Ph Ph Ph
	A Control of the cont
	MeO — COMe MeCO — OMe
CHO CHO CHO CHO	Ph of of
O Ph Po Po O	Pho Po W

OMe MeO OMe OMe OMe	N N N N N N N N N N N N N N N N N N N
N O Ph O PO N	O O O O O O O O O O O O O O O O O O O
CHO OME MEO CHO CHO OME MEO CHO MEO MEO CHO	O Pho Po
O Ph O Ph	Ph Ph